

DOCUMENT MICROFILMING IDENTIFICATION

G.I.-30 SEPT. 1976

GEOCRES No. 40I13-33  
DIST. 1 REGION Southwestern  
W.P. No. 42-66-14  
CONT. No. 76-122  
W. O. No. \_\_\_\_\_  
STR. SITE No. 14-361  
HWY. No. 402  
LOCATION Township Road  
Underpass

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. 3

REMARKS: documents to be unfolded  
before microfilming

# FOUNDATION INVESTIGATION REPORT

For

Township Road Underpass at  
Lambton and Middlesex County Line  
4.6 Miles East of Hwy. 79  
Hwy. 402, District 1, Chatham  
W.P. 42-66-14

---

## INTRODUCTION

This report contains the results of a foundation investigation carried out at the site of the above mentioned project. Field work was done during the period June 3rd to 8th, 1971, utilizing a continuous flight auger machine equipped with 4 inch O.D. solid augers.

## SITE DESCRIPTION

The site is located some 4.6 miles east of Hwy. 79 in Lots 1 and 30, Con. 1 and 2 S.E.R. Townships of Adelaide and Warwick, Counties of Middlesex and Lambton, at the intersection of Hwy. 402, Line 'C' and an existing gravel road. The surrounding area is generally flat with scattered scrub and trees. On the east side of the gravel road there is a 12 foot wide, 4 foot deep drainage ditch. At the time of the investigation water was flowing in the ditch. Physiographically the site is located in the region referred to as the Horseshoe Moraines.

## SUBSURFACE CONDITIONS

### General

Subsoil at the site consists of about 73 feet of firm to very stiff clayey silt overlying bedrock. Reference should be made to the Record of Borehole sheets contained in the report Appendix on which are shown the results of laboratory and field tests carried out during the investigation and the boundaries and descriptions of the soil types. Reference should also be made to Drawing No. 14-361-2 of the Contract Drawings which shows the locations and elevations of the borings, together with the inferred soil stratigraphy. A detailed description of the subsoil types encountered is given below.

### Sand and Gravel

This is fill material in the gravel road and is about 1.5 feet in thickness. It consists of well graded sand and gravel.

### Clayey Silt (Glacial Till)

This is the predominant soil deposit and was found in all boreholes. The thickness of the deposit varies from 73 to 74 feet.

The material, in general, consists of clayey silt with varying amounts (traces to some) of sand, and traces of gravel. The percentages of sand and gravel gradually increase with depth. There were occasional silt and/or fine sand seams, less than 1 inch to more than 1 foot in thickness. These seams were apparently randomly distributed but were more numerous in the upper half of the deposit. It is believed that these seams are water bearing.

The consistency of the material varies from firm to very stiff. Field vane tests indicate that the undrained shear strength varies from 1,280 p.s.f. to greater than 2,000 p.s.f. Only two laboratory unconfined compression tests were carried out to determine the undrained shear strength and the results were 700 and 1,120 p.s.f.

Physical properties of the cohesive material as determined from laboratory tests are as follows (see Fig. 1):

		<u>Min.</u>	<u>Max.</u>	<u>Average</u>
Liquid Limit	(%)	24	37	27
Plastic Limit	(%)	16	21	17
Natural Moisture Content	(%)	13	23	22

Grain size analyses performed on the same material indicate the following distributions and are plotted on Fig. 2.

		<u>Min.</u>	<u>Max.</u>
Gravel	(%)	0	9
Sand	(%)	0	16
Silt	(%)	57	86
Clay	(%)	16	41

Colour of the material was gray except for the upper 6-7 feet where it was brown.

### Bedrock

No bedrock was proven but in all boreholes the bedrock surface was assumed to be the level at which practical refusal to augering and/or to driving the split spoon was reached. The bedrock surface thus determined is relatively level and varies from elevation 703.3 to 704.1.

### Groundwater

The following water levels were observed during the field work:

Borehole 1	Elevation 773.2
2	773.3
3	773.1

Because the clayey silt material itself is relatively impermeable, therefore the seepage of water into the boreholes indicates that the silt and/or fine sand partings act as water bearing seams.

*K. G. Selby*

K.G. Selby, P. Eng.  
Supervising Engineer

KGS/PS/gs  
December, 1976

## ENGINEERING SERVICES BRANCH - GEOTECHNICAL OFFICE - SOIL MECHANICS SECTION

## RECORD OF BOREHOLE No 1

WP 42-66-14

LOCATION Sta. 101 ± 26 o/s 6' Lt. &amp; Twp. Rd.

ORIGINATED BY AP

DIST 1 HWY 402

BORING DATE June 8, 1971

COMPILED BY KW

DATUM Geodetic

BOREHOLE TYPE CME Flight Auger &amp; Cone Test

CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH PSF ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE 1000 2000 3000 4000 5000	LIQUID LIMIT $w_L$ PLASTIC LIMIT $w_p$ WATER CONTENT $w$ $w_p$ — $w$ — $w_L$ WATER CONTENT % 10 20 30	UNIT WEIGHT $\gamma$ PCF	REMARKS % GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	VALUES					
777.2	Ground Level									
775.7	Fill. Sand & gravel									
1.5			1	SS	3					
	Brown		2	SS	16					
	Grey		3	SS	21					0 0 (100)
			4	TW	PH					
	Clayey silt, traces		5	TW	PH				125	0 1 74 25
	to some sand		6	TW	PH					
	(increasing with		7	SS	17					0 16 63 21
	depth),									
	traces of gravel,									
	occasional silt &/or									
	fine sand seams									
	(Glacial Till)		8	SS	20					
	Firm to Very Stiff		9	SS	26					7 11 60 22
			10	SS	27					
703.7										Refusal to Augering
73.5	End of Borehole Probable Bedrock									
	Note: W.L. estimated									

20  
15  $\phi$  5 % STRAIN AT FAILURE  
10

## ENGINEERING SERVICES BRANCH-GEOTECHNICAL OFFICE - SOIL MECHANICS SECTION

## RECORD OF BOREHOLE NO 2

WP 42-66-14

LOCATION Sta. 99 + 98 o/s 7' Rt. C Twp. Rd.

ORIGINATED BY AP

DIST 1 HWY 402

BORING DATE June 3 - 4 1971

COMPILED BY KW

DATUM Geodetic

BOREHOLE TYPE CME Flight Auger &amp; Cone Test

CHECKED BY SO

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT $w_L$ PLASTIC LIMIT $w_P$ WATER CONTENT $w$			UNIT WEIGHT $\gamma$	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	$w_P$	$w$	$w_L$		
777.3	Ground Level															
775.8	Fill, Sand & gravel															GR SA 51 CL
1.5																
	Brown		1	SS	6											0 2 57 41
	Grey		2	SS	31											0 0 84 16
			3	SS	20											
			4	SS	9											
	Clayey silt		5	TW	PH											0 6 69 25
	traces to some sand		6	SS	10											0 3 88 9
	(increasing with depth),		7	TW	PH											
	traces of gravel,															
	occasional silt &/or															
	fine sand seams															
	(Glacial Till)		8	SS	23											0 14 61 25
	Firm to Very Stiff		9	SS	27											
			10	SS	20											7 30 50 13
703.3			11	SS	150/0"											Hammer bouncing
74.0	End of Borehole Probable Bedrock															refusal to augering

20  
15  $\diamond$  5 % STRAIN AT FAILURE  
10

## ENGINEERING SERVICES BRANCH-GEOTECHNICAL OFFICE-SOIL MECHANICS SECTION

## RECORD OF BOREHOLE NO 3

WP 42-66-14

LOCATION Sta. 98 + 71 o/s 5' Lt. E Twp. Rd.

ORIGINATED BY AP

DIST 1 HWY 402

BORING DATE June 7, 1971

COMPILED BY KW

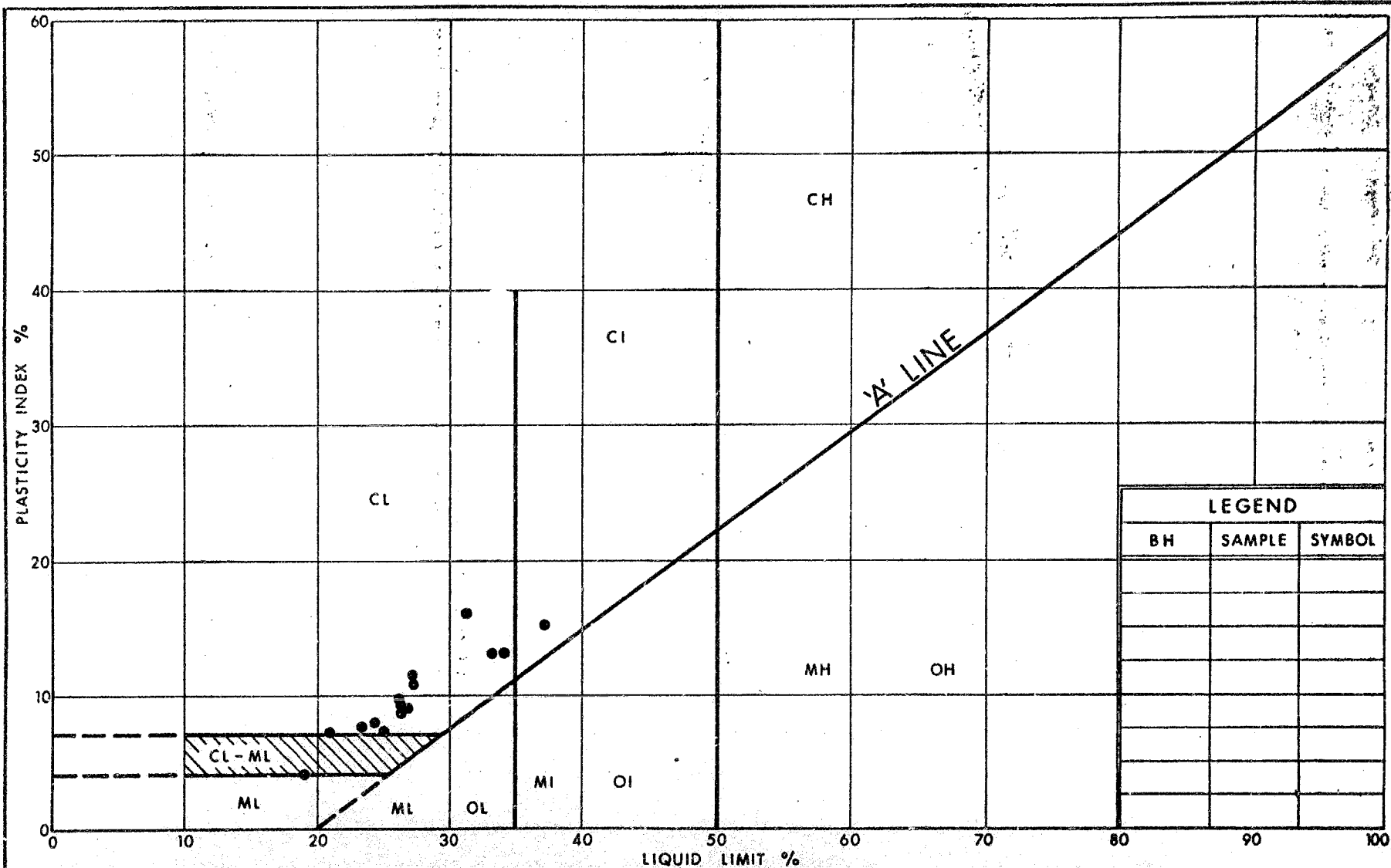
DATUM Geodetic

BOREHOLE TYPE CME Flight Auger &amp; Cone Test

CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT $w_L$ PLASTIC LIMIT $w_p$ WATER CONTENT $w$			UNIT WEIGHT $\gamma$ PCF	REMARKS % GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	$w_p$	$w$	$w_L$		
777.1	Ground Level															
775.6	Fill. Sand & gravel															
1.5			1	SS	20											
	Brown		2	SS	27	770										0 1 64 35
	Grey		3	SS	-											
			4	TW	PH	760										
			5	TW	PH											
	Silt		6	TW	PH	750									128	0 3 86 11 1 21 60 18
	Clayey silt, traces to some sand (increasing with depth)		7	SS	12											
	traces of gravel, occasional silt &/or fine sand seams		8	SS	15	740										3 15 53 29
	(Glacial Till)					730										
	Stiff to Very Stiff		9	SS	29	720										
			10	SS	25	710										9 6 62 23
704.1	Sand and gravel		11	SS	100.6"											Hammer bouncing 8 64 (28)
73.0	End of Borehole Probable Bedrock															refusal to augering

20  
15  $\phi$  5 % STRAIN AT FAILURE  
10



LEGEND		
BH	SAMPLE	SYMBOL



Ontario

Ministry of  
Transportation and  
Communications

ENGINEERING SERVICES BRANCH

## PLASTICITY CHART GLACIAL TILL

CLAYEY SILT, TRACES TO SOME SAND, TRACES OF GRAVEL

FIG No

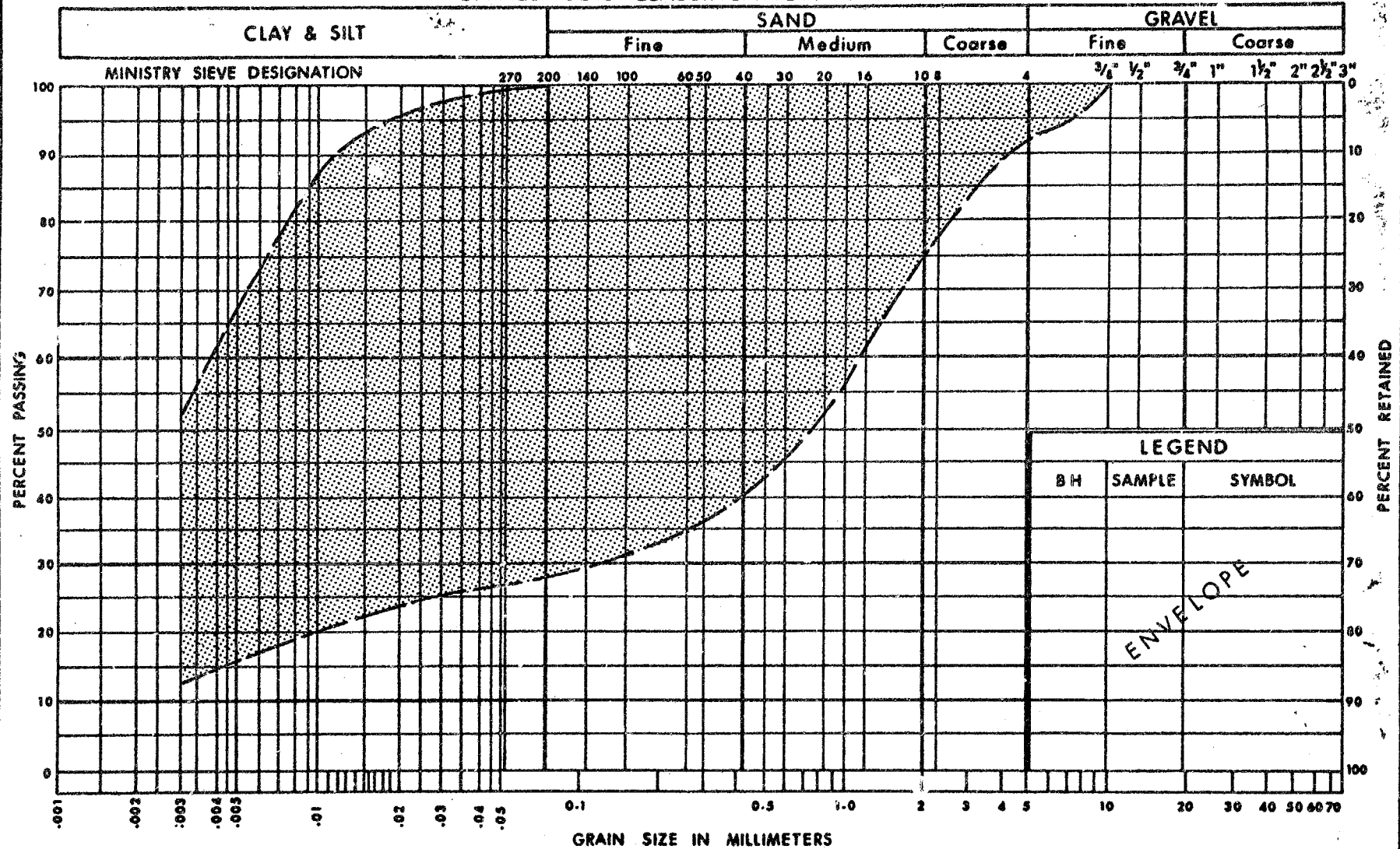
1

W P

42 - 66-14



# UNIFIED SOIL CLASSIFICATION SYSTEM



**Ministry of  
Transportation and  
Communications**

## ENGINEERING SERVICES BRANCH

# GRAIN SIZE DISTRIBUTION GLACIAL TILL

CLAYEY SILT, TRACES TO SOME SAND, TRACES OF GRAVEL

FIG No 2

WP 42 - 66 - 14



Memorandum

1287

To: Mr. A. Wittenberg,  
Regional Manager,  
Reg. Planning & Design,  
Southwestern Region, London.

From: Structural Office,  
West Building, Downsview.

Attention:

Date: June 18, 1976.

Our File Ref.

In Reply to

Subject: W. P. 42-66-14, Site 14-361  
(W.P. 41-66-01)  
Township Road Underpass,  
Highway 402, District 1

Please find enclosed four sets of prints of drawings  
14-361-1 and 3 to 16 inclusive.

One print of drawing 14-361-1 is being forwarded to the  
Systems Design Project Review Section.

One set of prints is also being forwarded to the following:

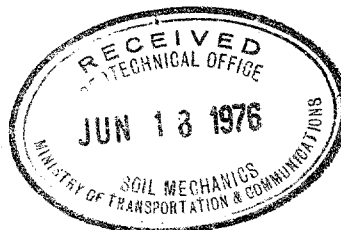
Estimating Section  
Regional Structural Planning Engineer  
Assistant Construction Engineer (Structures)  
District Office  
Structural Maintenance Engineer  
Soil Mechanics Section.

The D4 and Special Provisions were mailed to you previously.

NZ/cf  
Enc.

N. Zoltay,  
Structural Contract  
Specifications Engineer.

c.c. J. Wear  
B. Giroux  
A. Watt  
A. McKim  
A. Kelly  
E. Van Beilen  
C. Mirza  
A. Crowley  
J. Anderson



FOUNDATION INVESTIGATION REPORT  
For  
Proposed Crossing at  
C.A.H. 402, Line 'C' and Twp. Road  
(4.6 miles east of Hwy. 79)  
Twps.: Warwick & Adelaide  
Cos: Lambton & Middlesex  
District #1 (Chatham)  
W.O. 71-11044 --- W.P. 42-66-14

---

1. INTRODUCTION:

A request for a foundation investigation at the crossing of the proposed C.A.H. 402, Line 'C' and Township Road, 4.6 miles east of Hwy. 79, was received from Mr. A.P. Watt, Regional Bridge Planning Engineer, in a memorandum dated April 13, 1971.

A field investigation was subsequently carried out by the Foundation Section to determine the subsoil conditions existing at the site. This report contains the results of this investigation and our recommendations pertaining to the design of the proposed structure foundations and approach embankments.

2. DESCRIPTION OF THE SITE:

The site of the proposed structure is situated about 8 miles east of Warwick, approximately 1 mile south of Hwy. 22.

The surrounding area is flat with scattered scrub and trees on both sides. On the east side of the road, there is a 4 ft. deep and about 12 ft. wide drainage ditch running parallel to the Township Road. At the time of investigation, there was water flowing through the ditch.

2. DESCRIPTION OF THE SITE: (cont'd) ...

Physiographically, the site is located in the region referred to as the Horseshoe Moraines.

3. FIELD AND LABORATORY INVESTIGATION PROCEDURES:

A total of three sampled boreholes and three dynamic cone penetration tests were carried out during the course of the field work. Boring was achieved by means of a continuous flight auger machine. During the field work, disturbed samples were obtained by means of a standard split-spoon sampler: the energy used in driving it, conformed to the requirements of the Standard Penetration Test. Undisturbed samples were recovered using 2-inch I.D. Shelby tubes which were pushed into the soil hydraulically, or by hand. Where possible, field vane tests were carried out at elevations 12 inches below sample depths.

Dynamic cone penetration tests were carried out adjacent to each borehole. Driving energy used to advance the cone was 350 ft. - lbs. per blow.

All boreholes were surveyed in the field by personnel from London Region Engineering Survey Section. The locations and elevations of the borings are shown on Drawing No. 71-11044A, which accompanies this report.

All samples were visually examined and classified at the site as well as in the laboratory. Following this inspection, laboratory tests were carried out on selected samples to determine the following physical properties:

3. FIELD AND LABORATORY INVESTIGATION PROCEDURES: (cont'd) ...

Atterberg Limits

Moisture Content

Grain-Size Distribution

Undrained Shear Strength

Bulk Density

Consolidation Characteristics

The test results are summarized on the Record of Borehole sheets contained in the Appendix of this report.

4. SUBSOIL CONDITIONS:

4.1) General:

Generally, uniform subsoil conditions were found to prevail over the area investigated. The subsoil consists of a deep deposit of clayey silt with traces of sand, overlying bedrock.

The boundaries between various soil types are shown on the Record of Borehole sheets. The estimated stratigraphical profile shown on Drawing No. 71-11044A is based upon this information.

From ground level downward, the various strata are described in some detail with regard to soil types and soil properties, as follows:

4.2) Fill, Sand and Gravel:

This material was found in all boreholes to depths of 1.5 ft., and constitutes the fill placed for the gravel road. It consists of sand and gravel.

4.3) Clayey Silt:

This was the predominant soil deposit, and was found in all boreholes. All boreholes were terminated into this layer. The thickness of the deposit varies from 73.0-74.0 ft.

4. SUBSOIL CONDITIONS: (cont'd) ...

4.3) Clayey Silt: (cont'd) ...

The material, in general, consists of clayey silt with varying amounts (traces to some) of sand, and traces of gravel. The percentage of sand and gravel gradually increases with depth. There were occasional silt and/or fine sand seams, less than 1 inch to more than 1 ft. in thickness. These seams were apparently randomly distributed, but were more numerous in the upper half of the deposit. It is felt that these seams are water bearing.

The consistency of the material varies from firm to very stiff. Field vane tests indicate that the undrained shear strength varies from 1,280 p.s.f. to greater than 2,000 p.s.f. Only two laboratory tests were carried out to determine the undrained shear strength, and the results vary from 700 to 1,120 p.s.f.

Physical properties of the cohesive material, as determined from laboratory tests are as follow: (see Fig. 1)

		<u>Min.</u>	<u>Max.</u>	<u>Average</u>
Liquid Limit	(%)	24	37	27
Plastic Limit	(%)	16	21	17
Natural Moisture Content	(%)	13	23	22

Grain-size analyses performed on the same material indicate the following distributions, and are plotted on Fig. 2.

		<u>Min.</u>	<u>Max.</u>
Gravel	(%)	0	9
Sand	(%)	0	16
Silt	(%)	57	86
Clay	(%)	16	41



4. SUBSOIL CONDITIONS: (cont'd) ...

4.3) Clayey Silt: (cont'd) ...

Colour of the material was gray, except for the upper 6 - 7 ft., where it was brown.

4.4) Bedrock:

No bedrock was proven, but in all boreholes the bedrock surface was assumed to be the level at which practical refusal to augering and/or to driving the split-spoon was reached. The bedrock surface is relatively level and varies from Elevation 703.3 to 704.1.

5. GROUNDWATER CONDITIONS:

The following water levels were observed during the field work:

Borehole	1	Elevation	773.2
	2		773.3
	3		773.1

Because the clayey silt material itself is relatively impermeable, therefore, the seepage of water into the boreholes indicates that the silt and/or fine sand partings act as water bearing seams.

6. DISCUSSION AND RECOMMENDATIONS:

6.1) General:

It is proposed to construct a two-span (126'-126') underpass structure at the crossing of new Hwy. 402, Line 'C' and Township Road, 4.6 miles east of Hwy. 79. The proposed grade of Hwy. 402 will be at approx. elevation 777.0, i.e., the

6. DISCUSSION AND RECOMMENDATIONS: (cont'd) ...

6.1) General: (cont'd) ...

same as the present grade of the Township Road. The future grade of the Township Road will be at approximate elevation 799.0, resulting in a maximum approach height of about 22 ft.

In general, the subsoil at the site consists of about 73 ft. of firm to very stiff clayey silt with traces of sand, overlying bedrock.

6.2) Foundations:

a) Spread Footings in Original Ground

The entire structure may be supported on spread footings placed at approximate Elevation of 770.0 in the desiccated zone of the subsoil. A safe net pressure of 2.0 tons/sq. ft. may be used for design purposes.

The upper zone of the subsoil is desiccated and is, therefore, susceptible to softening on contact with water. Therefore, it is recommended that the base of the footing excavations be protected by a concrete working slab, immediately on exposure. Because the silt and/or sand seams are water bearing and if they are intersected while excavating, an inflow of water from the sides into the excavation may be expected. If one of the seams occurs at the bottom of excavation, then some loosening of silty material may occur, because of unbalanced hydrostatic head. In that case it will be necessary to excavate slightly deeper down to the cohesive material and the loose material will be removed. However, no major problems are anticipated.



6. DISCUSSION AND RECOMMENDATIONS: (cont'd) ...

6.2) Foundations: (cont'd) ...

b) Spread Footings on Compacted Fill:

As an alternative, the abutments may be supported on spread footings placed on well compacted, suitable granular material within the approach fills. A safe design load of 2.0 TSF may be assumed. The granular material should consist of G.B.C. Class 'A' and should be fully compacted according to the current D.H.O. Standards. A detailed construction scheme is outlined on Figure 3 of the Appendix.

c) Perched Abutments on Short Piles:

As a second alternative, the abutments may be constructed within the approach fills and supported on short piles driven through the fill and some 10.0 ft. into the original ground. In the case of 12-3/4" O.D. and 1/4" thick wall steel tube piles, a safe design load of 25 tons per pile may be used.

It is estimated that the following maximum settlements will occur in the subsoil at various locations over a long period of time following the end of construction.

Pier -	Spread footings in original ground	1.0 - 1.5 inches
Abutment -	Spread footings in original ground	} 3.0 - 4.0 inches
	Spread footings on compacted fill	
	Perched abutments on short piles	

Regardless of which of the above methods is adopted, the structure should be built to accommodate the 3.0 inches differential settlements between the abutments and the pier.

6. DISCUSSION AND RECOMMENDATIONS: (cont'd) ...

6.2) Foundations: (cont'd) ...

d) End-Bearing Piles:

As another alternative, the abutments and pier may be supported on steel H-piles driven to refusal into the bedrock. For design purposes the maximum allowable design load may be used for the particular steel section used.

All foundations and pile caps should be protected against frost action by at least 4 ft. of earth cover.

6.3) Approach Embankments:

The shear strength of the subsoil is such that it will be able to safely support the 22-ft. high approach embankments constructed with 2:1 side slopes. The fill should consist of well compacted acceptable material. Care should be taken to ensure that no bouldery fill is placed within the approaches through which piles have to be driven, and it is recommended that this portion of the fill contain no larger grain sizes than 3 inches.

Based on the performance of structures and embankments built in the same general area and with somewhat similar subsoil conditions, it is estimated that maximum settlements of 3 to 4 inches will occur beneath the abutment locations. To minimize the effect of differential settlements between the abutments and pier footings, it is recommended that the approach embankments be built in advance of the structure for as long a period as possible. The topsoil and any organic material should be removed in accordance with the pertinent D.H.O. Standards within the construction area.

7. MISCELLANEOUS:

The field investigation was carried out during the period June 3- 8, 1971, under the supervision of Mr. A. Prakash, Project Foundation Engineer, who also prepared this report.

Equipment was owned and operated by Dominion Soil Investigation Ltd.

This report was reviewed by Mr. K. C. Selby, Supervising Foundation Engineer.

June, 1971

DEPARTMENT OF HIGHWAYS- ONTARIO  
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 1

FOUNDATION SECTION

JOB 71-11044      LOCATION Twp. Rd. Sta. 101 + 26 o/s 6' Lt.      ORIGINATED BY AP

W.P. 42-66-74      BORING DATE June 8, 1971      COMPILED BY KW

DATUM Geodetic      BOREHOLE TYPE CME Flight Auger & Cone      CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT — $w_L$ PLASTIC LIMIT — $w_p$ WATER CONTENT — $w$		BULK DENSITY $\gamma$ P.C.F.	REMARKS					
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		SHEAR STRENGTH P.S.F.		WATER CONTENT %								
					20		40	60	80	100			1000	2000	$w_p$	$w$	$w_L$
UNCONFINED		+ FIELD VANE		QUICK TRIAXIAL		x LAB. VANE											

777.2	Ground Level												
775.7	Fill. Sand & Gravel												
1.5													
			1	SS	3								▼ 773.2 = estimate
	Brown		2	SS	16	770							0 0 (100)
	Grey		3	SS	21								
			4	TW	PH	760							
	Clayey silt, traces to some sand (increasing with depth) traces of gravel. Occ. silt &/or Fine sand seams. (Glacial Till)		5	TW	PH							125	0 1 74 25
			6	TW	PH	750							0 16 63 21
			7	SS	17								
	Firm to Very Stiff		8	SS	20	740							
			9	SS	26	730							7 11 60 22
			10	SS	27	720							
						710							
703.7													Refusal to augering
73.5	End of Borehole Probable Bedrock					700							

## RECORD OF BOREHOLE No. 2

JOB 71-11044

LOCATION

TWP. Rd. Sta. 99 + 98 o/s 7' Rt.

ORIGINATED BY AP

W.P. 42-66-14

BORING DATE

June 3 - 4, 1971

COMPILED BY KW

DATUM Geodetic

BOREHOLE TYPE

CME Flight Auger &amp; Cone

CHECKED BY

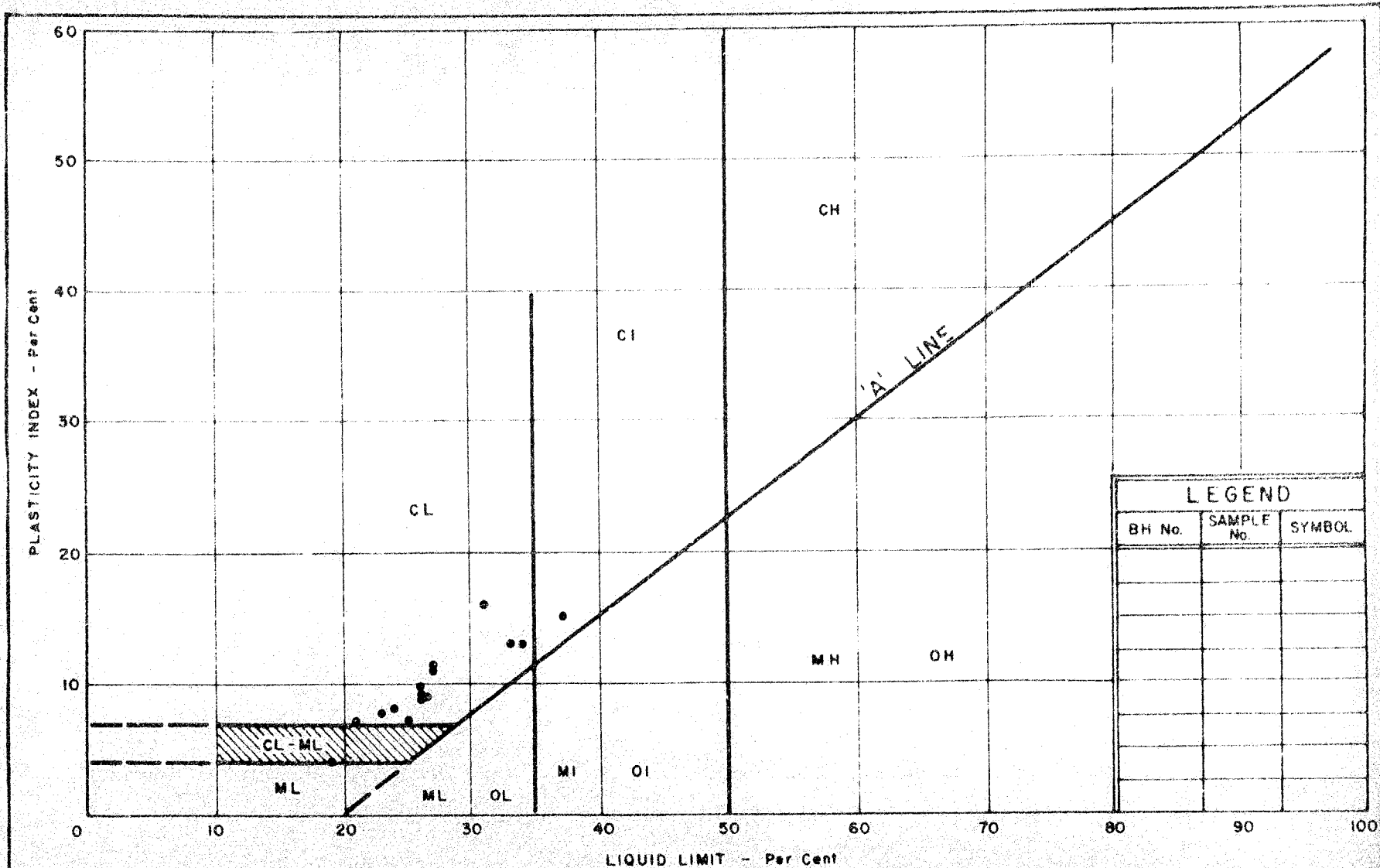
SOIL PROFILE		STRAT. PLOT	SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT — $w_L$ PLASTIC LIMIT — $w_p$ WATER CONTENT — $w$			BULK DENSITY $\gamma$	REMARKS
ELEV. DEPTH	DESCRIPTION		NUMBER	TYPE	BLOWS / FOOT		20	40	60	80	100	$w_p$	$w$	$w_L$		
777.3	Ground Level															
775.8	Fill, Sand & Gravel															
1.5																
	Brown Grey		1	SS	6											777.3
			2	SS	31	770										0 2 57 41
			3	SS	20											
			4	SS	9	760										0 0 84 16
	Clayey silt		5	TW	PH											
	Traces to some Sand		6	SS	10	750										0 6 69 25
	(increasing with depth)		7	TW	PH											0 3 88 9
	traces of gravel.															
	occ. silt &/or Fine sand seams.															
	(glacial till)					740										
	Firm to Very Stiff		8	SS	23											0 14 61 25
			9	SS	27	730										
						720										
			10	SS	20	710										7 30 50 13
703.3			11	SS	150/0"											Hammer bouncing refusal to augering
74.0	End of Borehole Probable Bedrock															

# RECORD OF BOREHOLE No. 3

FOUNDATION SECTION

JOB 71-11044 LOCATION Twp. Rd. Sta. 98 + 71 o/s 5' Lt. ORIGINATED BY AP  
W.P. 42-66-14 BORING DATE June 7, 1971 COMPILED BY KW  
DATUM Geodetic BOREHOLE TYPE CME Flight Auger & Cone CHECKED BY AK

SOIL PROFILE		SAMPLES			DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT — $w_L$ PLASTIC LIMIT — $w_p$ WATER CONTENT — $w$			BULK DENSITY $\gamma$ P.C.F.	REMARKS			
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT	BLOWS / FOOT					SHEAR STRENGTH P.S.F.				WATER CONTENT %		
							20	40	60	80	100	UNCONFINED + FIELD VANE QUICK TRIAXIAL x LAB. VANE			20 40 60		
777.1	Ground Level																
775.6	Fill. Sand & Gravel																GR. SA. SI. CL.
			1	SS	20												773.1
	Brown		2	SS	27	770											0 1 64 35
	Grey		3	SS	-												
			4	TW	PH	760											
			5	TW	PH												
	Silt		6	TW	PH	750										128	0 3 86 11 1 21 60 18
	Clayey silt, traces to some sand (increasing with depth), traces of gravel occ. silt &/or fine sand seams. (Glacial Till) Stiff to Very Stiff		7	SS	12	740											
			8	SS	15	730											3 15 53 29
			9	SS	29	720											
			10	SS	25	710											9 6 62 23
704.1	Sand & gravel		11	SS	100/6"												Hammer bouncing 8 64 (23)
73.0	End of Borehole Probable Bedrock																Refuse to augering



DEPARTMENT OF HIGHWAYS  
MATERIALS and  
TESTING  
DIVISION

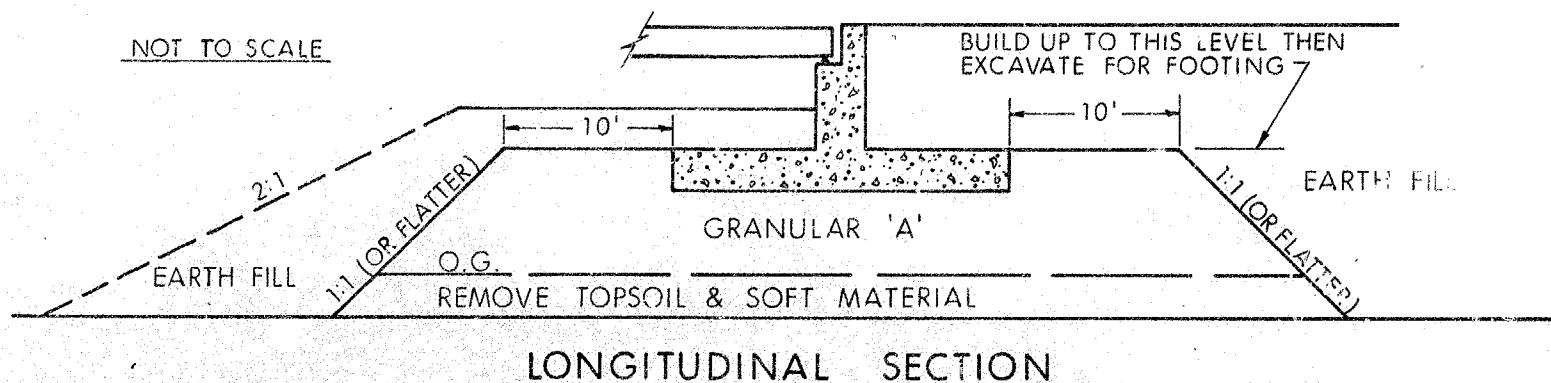
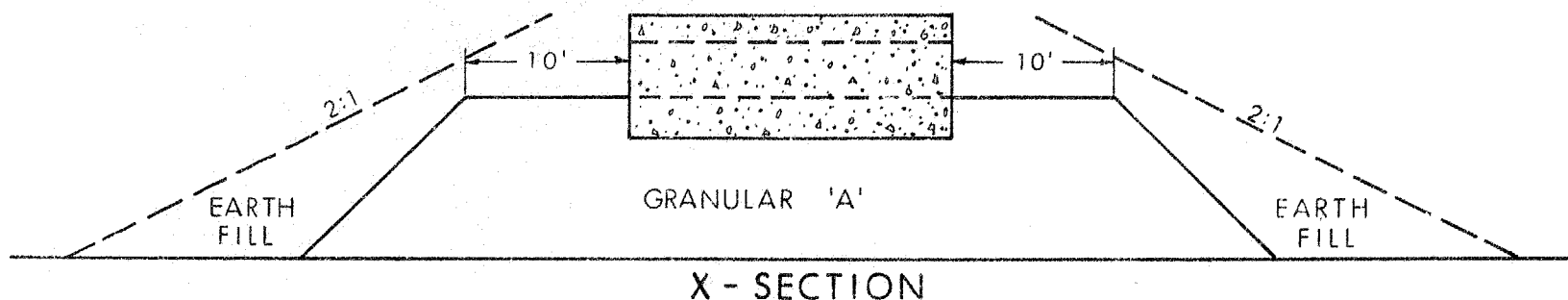
# PLASTICITY CHART CLAYEY SILT

WP No. 42-66-14  
JOB No. 71-11044  
FIG. 1





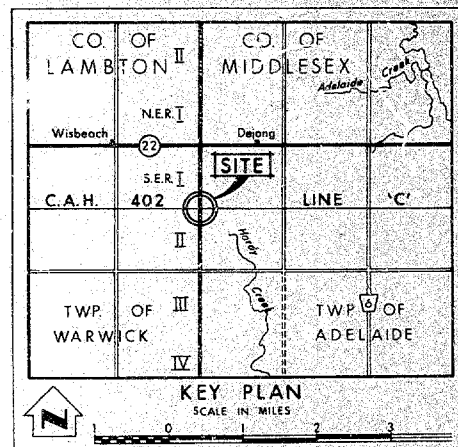
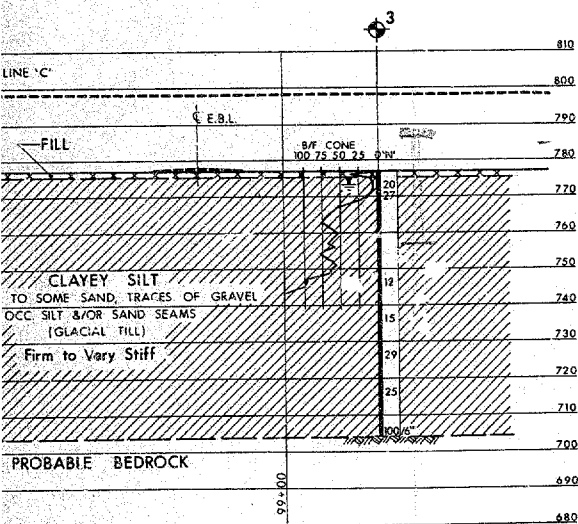
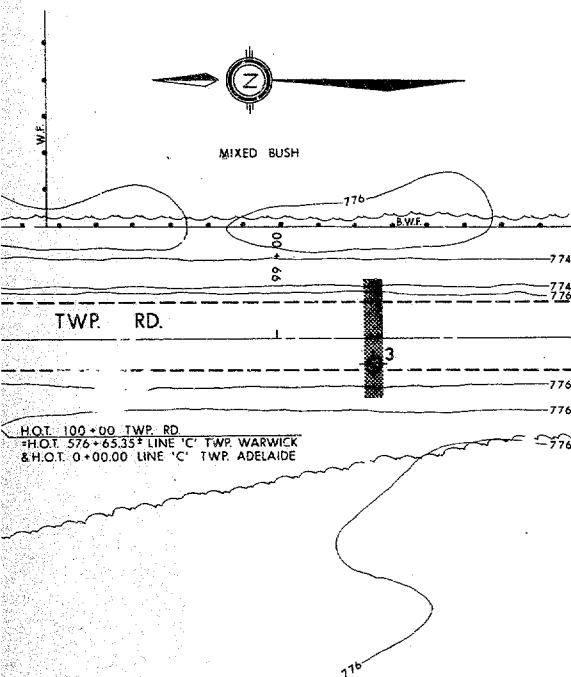
## ABUTMENT ON COMPACTED FILL SHOWING GRANULAR 'A' CORE



### NOTES

- 1 - REMOVE TOPSOIL &/OR SOFT SUBSOIL UNDER AREA OF COMPACTED GRANULAR 'A'.
- 2 - PLACE GRANULAR 'A' TO TOP OF FOOTING LEVEL, COMPACTED ACCORDING TO CURRENT D.H.O. STANDARDS.
- 3 - EXCAVATE COMPACTED GRANULAR 'A' MATERIAL FOR FOOTING.





LEGEND			
	Bore Hole		
	Cone Penetration Test		
	Bore Hole & Cone Test		
	Water Levels established at time of field investigation: JUNE 1971		
NO.	ELEVATION	STATION	OFFSET
1	777.2	101+26	6' LT.
2	777.3	99+98	7' RT.
3	777.1	98+71	5' LT.

**NOTE**

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence and may be subject to considerable error.

REVISIONS	DATE	BY	DESCRIPTION

DEPARTMENT OF TRANSPORTATION & COMMUNICATIONS  
DESIGN SERVICES BRANCH - FOUNDATION SECTION

**TOWNSHIP ROAD**  
4.6 MILES EAST OF HWY NO. 79

HIGHWAY NO. **402** LINE 'C' DIST. NO. **1**

CO. **MIDDLESEX & LAMBTON**

TWP. **ADELAIDE & WARWICK** LOT **1 & 30** CON. **1 & 2 S.E.**

**BORE HOLE LOCATIONS & SOIL STRATA**

SUBMD. A.P.	CHECKED A.P.	W.P. NO. 42-66-16	M.B.T. DRAWING NO.
DRAWN A.N.	CHECKED A.N.	JOB NO. 71-11044	<b>71-11044 A</b>
DATE 29 JUNE 1971	SITE NO.	BRIDGE DRAWING NO.	
APPROVED <i>[Signature]</i>	CONT. NO.		

PRINCIPAL FOUNDATION ENGINEER



Memorandum

To: Mr. A. Wittenberg,  
Manager, Planning and Design,  
London.

From: Materials and Testing Office,  
London.

Attention: Mr. T. A. Hickey.

Date: April 20, 1976.

Our File Ref.

In Reply to

Subject: W.P. 41-66-01, Highway 402,  
Township of Adelaide,  
Culvert Sites, London District.  
-----

As a follow up to our memo dated March 1, 1976 proposed culvert sites in Adelaide Township were checked in the field to determine subsoil conditions at the respective sites. A backhoe was used to dig test holes where access could be made with this type of equipment. Shear tests were attempted at the sites as well but it was not possible to penetrate and turn the vane in the firm clay subsoil.

From our survey it was noted that a firm medium clay till was encountered at the footing level at the following sites and that a safe bearing capacity of 3.0 kips per square foot may be used for design.

<u>Station</u>	<u>Top of Footing Elevation</u>
216 + 20	792.5
230 + 80	786.3
252 + 80	789.0
387 + 00	787.3
416 + 16	797.5
519 + 00	806.0
533 + 30	801.2

In view of these conditions, it is also recommended that 3.0 kips per square foot be used in design at the following sites where test holes were not possible due to bush areas or permission to enter could not be obtained.

<u>Station</u>	<u>Top of Footing Elevation.</u>
130 + 00	773.4
320 + 90	774.1
348 + 28	778.8

It is recommended that these latter sites be reviewed closely in the field once the excavation has been dug to ensure a firm foundation for the culvert footings.



We are forwarding field data, together with laboratory results in order that it may be placed on the Contract Drawings.

JMcK:hp.

ATT'D.

c.c. - D. P. Collins,  
J. Wear,  
G. A. Wrong,  
K. Kelby,  
A. Watt,  
J. McKeown,  
File.

*J. McKeown for J.G.*  
J. McKEOWN,

FOR: J. G. FORSTER,  
SENIOR SOILS ENGINEER.

216+20 E Blvd.

0	-	8"	Tps		
8"	-	10"	Br M Cl Till (wet to 24")	76AX67	
			Br M Cl	VF & F Sa	8
				Si	34
				Cl	58
				VF Sa&Si	42
				LL	34.6
				PL	17.5
				PI	17.1
				FMC	17.2

230+80 E Blvd.

0	-	12"	Tps		
12"	-	10"	Br M Cl Till	76AX68	
				F&VF Sa	8
				Si	37
				Cl	55
				VF Sa&Si	45
				LL	33.9
				PL	18.5
				PI	15.4
				FMC	18.0

252+00 E Blvd.

0	-	12"	Tps		
12"	-	7"	Br M Cl Till (wet to 4")		
7"	-	10"	Gry M Cl Till	76AX69	
				F&VF Sa	10
				Si	34
				Cl	56
				VF Sa&Si	44
				LL	28.7
				PL	13.6
				PI	15.1
				FMC	15.8

319+00 E

0	-	10"	Tps		
0"	-	7"	Br M Cl Till (wet to 3")	76AX63	
				F&VF Sa	4
				Si	27
				Cl	69
				VF Sa&Si	31
				LL	37.7
				PL	17.9
				PI	18.9
				FMC	19.2

533+30 E EBL

0	-	10"	Tps		
10"	-	8"	Br M Cl Till (sat to 3")		
8"	-	14"	Br & Gry M Cl Till	76AX64	
				Br H Cl - M Cl	
				F&VF Sa	4
				Si	26
				Cl	70
				VF Sa&Si	30
				LL	38.5
				PL	18.8
				PI	19.7
				FMC	22.4

416+16 35° Rt E Blvd.

0	-	9"	Tps		
9"	-	10"	Br M Cl Till (sat. to 3")	76AX65	
				F&VF Sa	5
				Si	32
				Cl	63
				VF Sa&Si	37
				LL	36.2
				PL	18.8
				PI	17.4
				FMC	18.2

387+00 30° Rt E

0	-	9"	Tps		
9"	-	9"	Br M Cl Till (sat. 3")	76AX66	
				Br M Cl	
				F&VF Sa	7
				Si	33
				Cl	60
				VF Sa&Si	40
				LL	34.7
				PL	16.8
				PI	17.9
				FMC	17.5

DOCUMENT IDENTIFICATION

GEOCRES No. 40 I 13-33

DIST. 1 REGION SOUTHWESTERN

W.P. No. 42-46-14

CONT. No. 76-122

W. O. No. \_\_\_\_\_

STR. SITE No. 14-361

HWY. No. 402

LOCATION TOWNSHIP ROAD UNDERPASS

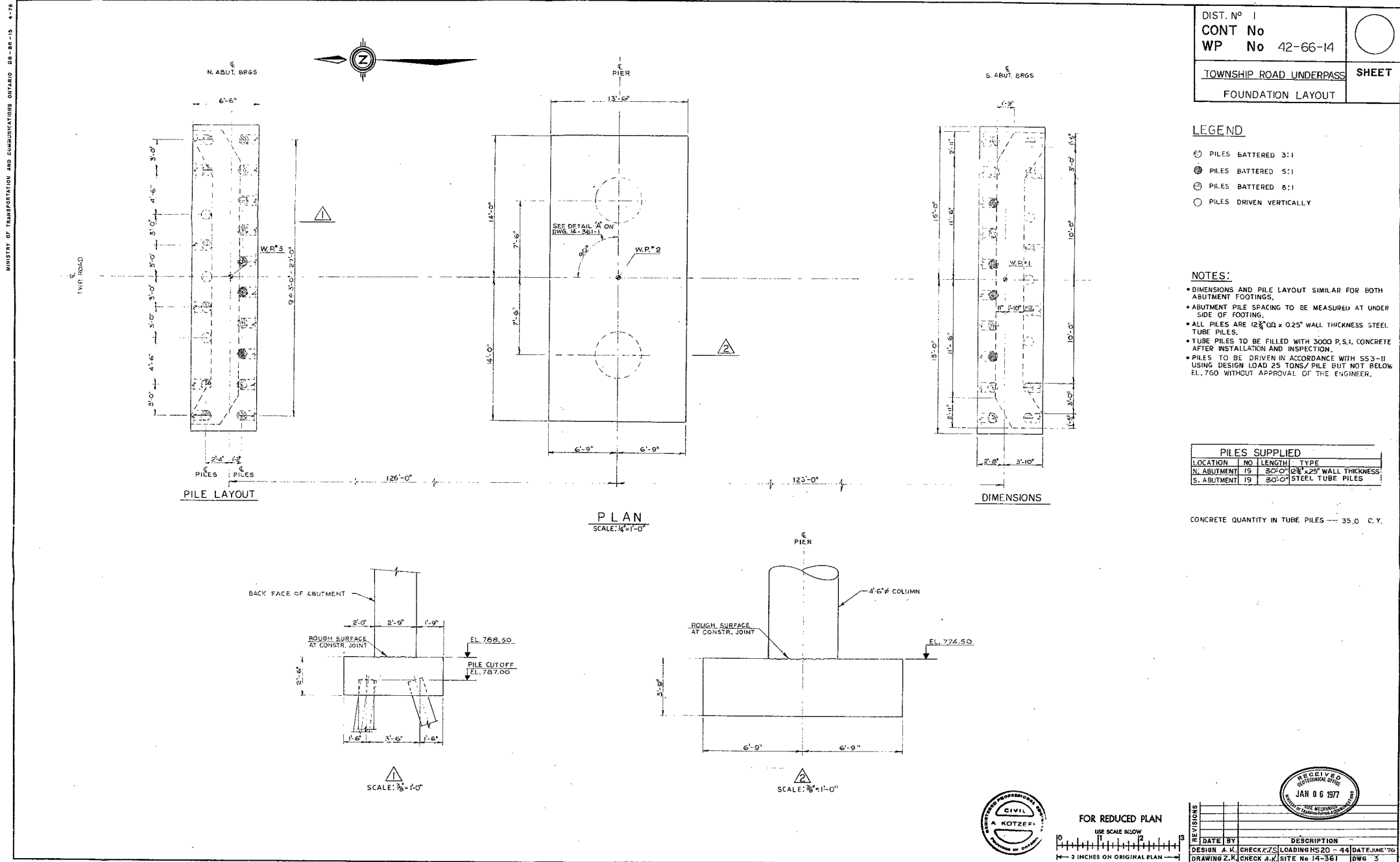
OVERALL INFORMATION TO BE INCLUDED IN THE REPORT 3

REMARKS: \_\_\_\_\_

\_\_\_\_\_

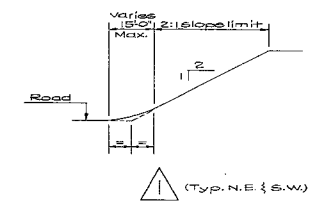
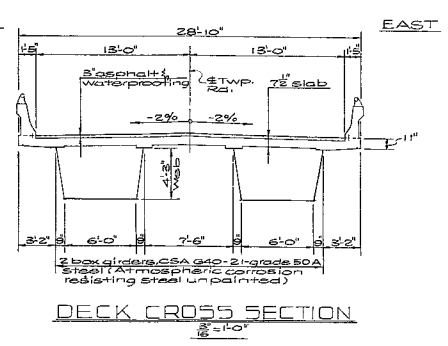
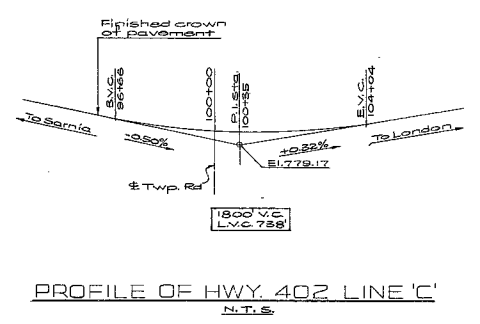
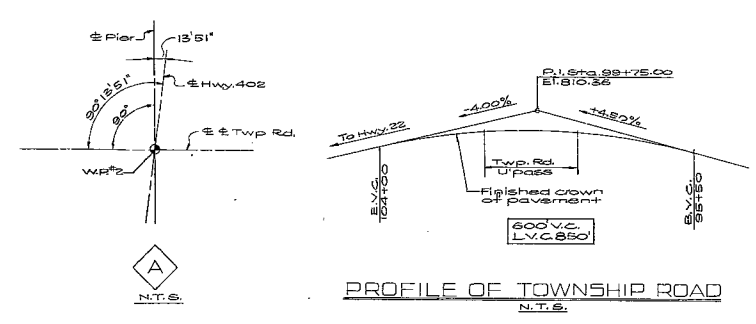
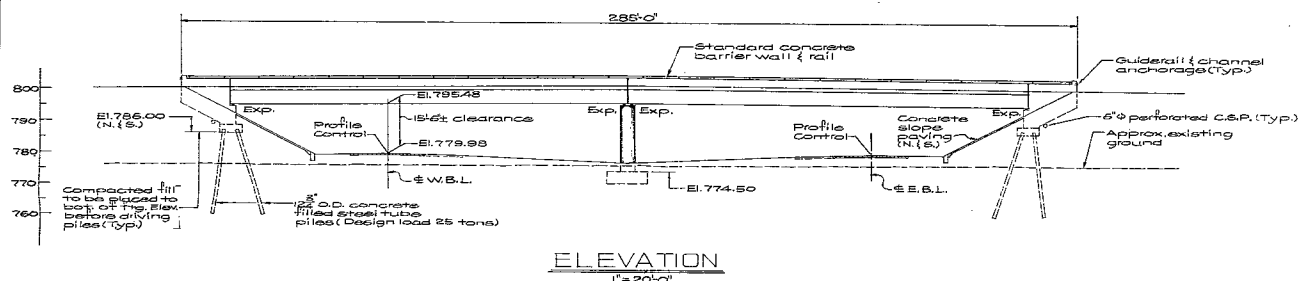
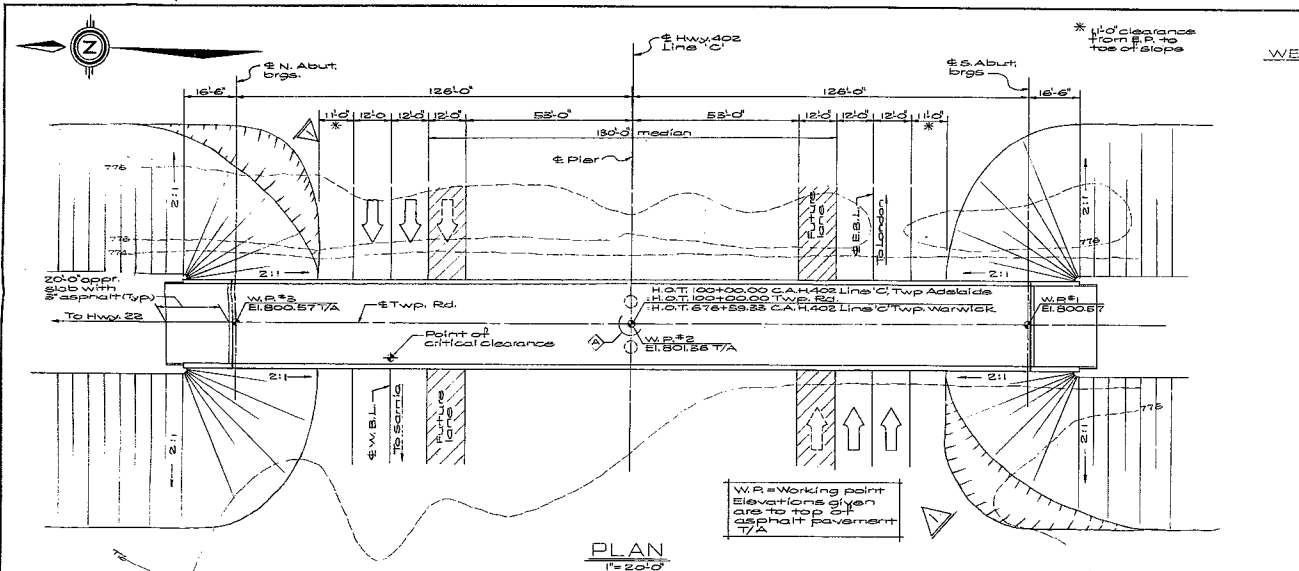
\_\_\_\_\_

\_\_\_\_\_



4013-33





# LIST OF DRAWINGS

- 1-261-1 General Plan
- 2 Borehole Locations
- 3 Foundation Layout
- 4 Abutments
- 5 Pier
- 6 Structural Steel
- 7 Bearings
- 8 Deck
- 9 Concrete Barrier Walls
- 10 Steel Parapet Railing
- 11 20 Ft. Approach Slab
- 12 Details of Conc Slope Paving
- 13 Standard Details I
- 14 Standard Details II
- 15 Standard Details III
- 16 As Constructed Elev. & Dim.

DIST. No. 1	
CONT No	
WP No	42-66-14
TOWNSHIP ROAD UNDERPASS	
At London (Middlesex County)	
Line 2.66 miles east of Hwy. 78	
GENERAL PLAN	HWY 402

**NOTES**

Class of Concrete  
Deck & barrier wall 4000 R.S.I.  
Pier columns 4000 R.S.I.  
Remainder 3000 R.S.I.  
or as noted on drawings

Clear Cover on Reinf. Steel  
Footings 5"  
Abutts. (pier columns) 2" top, 1" bot.  
Barrier walls 1"  
Approach slabs 2"  
or as noted on drawings

**Construction Notes**  
The Contractor is responsible for finishing the bearing seats dead level to the specified elevations with a tolerance of 1/8".  
No concrete shall be placed above the abutment bearing seats until concrete in the deck has been placed.

**Reinforcing Steel**  
Grade 60 is required for some of the deck reinforcing steel as identified on the deck drawing & rebar schedule.

**Concrete Quantities**  
Concrete quantities are listed below for the appropriate concrete turn sum tender items.  
Concrete in pier, abutts. 4000 R.S.I. 25 CY  
{ wingwalls } 3000 R.S.I. 79 CY  
Concrete in deck 198 CY  
Concrete in barrier walls 50 CY  
Concrete in approach slabs 35 CY  
Concrete in slope paving 30 CY

**Structural Steel Quantities**  
Total 136 tons

B.M. 776.92  
Geodetic Datum  
N.W. in NE cor. of Q.S. map  
277' Lt. 575+78 Line 'C'



FOR REDUCED PLAN  
USE SCALE BELOW  
1"=3 INCHES ON ORIGINAL PLAN

REVISION	DATE BY	DESCRIPTION
1	DESIGN A.R.	CHECK 7/75 LOADING HS-20-44 DATE June 76
2	DRAWING D.C.	CHECK 4/76 SITE No 14-261 DWG 1

40I13-33

